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Research Article

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Clinical and Radiological Features Associated with Bladder Invasion and Need for Urological Intervention in Suspected Placenta Accreta

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Abstract

Purpose: *We investigated clinical and radiological predictors of bladder invasion and need for urological intervention in pregnant women with suspected placenta accreta.*

Methods: *We conducted a retrospective study including pregnant women with ultrasonographic (US) suspicion of placenta accreta. Surgical and clinical data were reviewed, and seven US parameters were used to classify the patients. A single and expert radiologist reviewed Magnetic Resonance Imaging (MRI) and used nine parameters for classification. Chi-square, Fisher´s exact test or Mann-Whitney and logistic regression were used to calculate the risk of bladder invasion and need of cystorrhaphy for continuous variables.*

Results: *Twenty-seven patients fulfilled all the inclusion criteria, and the histological diagnosis of placenta accreta, increta or percreta was performed in 5, 8 and 14 patients respectively. Regarding clinical data, the risk of placenta percreta increases 35.7% for each maternal year and three times for each cesarean section. Bilateral prophylactic double J catheter was attempted in all patients, but successful in 81,48%, mostly in percreta patients. There were signs of bladder invasion in 9 patients, all with placenta percreta. The risk of bladder injury suture increases by 26.41% for each maternal year, in the same way, increase 5.7 times for each cesarean section.*

Conclusion: *Maternal age and number of cesareans are the only direct predictors of the depth of placental invasion and risk of urological intervention. None US or MRI parameters had a predictive role in the depth of invasion or to the risk of cystorrhaphy.*

Keywords: Abnormal Invasive Placenta, Placenta Percreta, Ultrasonography, Magnetic Resonance, Bladder Injury

Introduction

Placenta accreta is an obstetric condition characterized by an abnormal adhesion of placenta to the uterine wall. This term refers to an extensive clinical range, classified according to the length and depth of placental invasion. First, once the placenta is just attached to myometrium but without a real invasion, it is termed placenta accreta. In the other hand, placenta increta has a partial myometrium invasion. Finally, in the worst clinical scenario, placenta percreta occurs by entire myometrium to serosa thickness involvement, occasionally into adjacent organs, such as bladder [1].

This condition typically occurs in women with placenta previa associated with any previous uterine scar, mainly after cesarean deliveries [2]. Due to the increasing cesarean delivery rates, a significant problem in developing countries, the incidence of placenta accreta seems to rise in parallel [3]. It has been proposed that cesarean sections cause decidua replacement by scar tissue, which impacts in both implantation and placentation, leading to dysfunctional decidualization and trophoblastic over invasiveness [4].

During delivery, this condition turns out to be highly morbid. One of the chief concerns is massive bleeding, leading to shock and requiring transfusion in about 80% of patients [5]. Placenta accreta is also responsible for almost 40% of hysterectomy at the same time of cesarean section, corresponding to its leading indication [6]. In this tempestuous setting, inadvertent pelvic organ injury may happen, either by the invasiveness of placenta or by a hardness of an urgent surgical procedure, occasionally requiring urological intervention.

The antenatal diagnosis is an essential challenge for management planning in this complex scenario. Besides the lack of access to qualified obstetricians and obstetric radiologists, the accuracy of ultrasound and MRI for diagnosis of placenta accreta is controversial, depending on the experience of radiologist and correlation to previous medical history [7]. Furthermore, the radiological features that predict the depth of placental invasion and the need for urological intervention are still unknown.

Our objective was to characterize the clinical and radiological features associated with depth of placental invasion and its correlation to urologic injuries and interventions in patients with placenta accreta.

Materials and Methods

After obtaining Institutional Review Board approval in the University of Campinas with protocol number 58/2016, we retrospectively reviewed the medical records of all patients who presented to our tertiary hospital with any suspicious finding of placenta accreta on obstetric ultrasound between January 2009 and December 2016. Histologic analysis confirmed the diagnosis and depth of placental invasion. Thus, patients without pathological confirmation of any spectrum of placenta accreta were excluded. All patients signed informed consent before their enrollment in the study.

Besides patients' clinical history, we revised antenatal imaging reports. All ultrasounds were performed in our institution, by experienced radiologists, using a grayscale and color Doppler scanning via transabdominal and endovaginal approaches. Evaluation of sonographic parameters included: location of the placenta, loss of retroplacental clear zone, interruption of the uterine-bladder interface, adjacent bladder wall hypervascularity, cervical hypervascularity, the presence of multiple placental lacunae and placental bulge.

Furthermore, antenatal MRI images were recovered and systematically reviewed by one experienced radiologist, who was blinded for previous imaging report, surgical outcomes and final pathological diagnosis. His analysis focused on the following parameters: abnormal uterine bulge, myometrium thickness, the location of the placenta, placental heterogeneity, intraplacental thick T2 dark bands, abnormal intraplacental vascularity, placental protrusion into the internal cervical os, loss of the uteroplacental interface, and placental invasion into adjacent structures.

According to our multidisciplinary institutional protocol, including obstetricians, urologists, vascular surgeons, radiologists, neonatologists, anesthesiologists and intensive care specialists, a planned delivery was projected between 34-36 weeks, followed by prophylactic bilateral ureteral stenting, uterine arterial embolization, and hysterectomy. Besides prophylactic ureteral stenting, we assessed possible urological lesions (bladder and ureters) and procedures (bladder injury suture, partial cystectomy, ureteral reimplantation).

Categorical variables were compared using chi-square, Fisher exact tests, whereas continuous variables were analyzed using the Mann-Whitney test. We calculated the odds ratio (OR) when appropriate. The significance level was set at $p < 0.05$. All statistical analyses were performed using SAS System version 9.4 (SAS Institute Inc, Cary, NC, USA).

Results

A total of 28 patients fulfilled inclusion criteria with suspicious imaging of placenta accrete, but one patient was excluded due to absence of histological confirmation, resulting in 27 patients who were categorized based on the depth of placental invasion as accreta (5/27, 18,5%), increta (8/27, 29,6%) and percreta (14/27, 51,8%). Considering the reduced number of patients and clinical management similarity, we grouped placenta accreta and increta for statistical purposes.

Initially, we compared demographic data with histological diagnosis (Table 1). The placenta percreta associated with increased maternal age and number of cesarean deliveries, so that the risk of placenta percreta increases 35.7% for each maternal year old (OR=1.357; 95% CI 1.073 to 1.716; p=0.0108) and by 3 times for each cesarean delivery (OR= 3.067; 95% CI 1.7030 to 19,0902; p=0.0005). No association was found among other clinical variables, like gestational age, number of gestations, parity, and abortions.

Table 1: Comparison of Demographic Data among Patients with Placenta Increta/Accreta versus Placenta Percreta

	Total (n=27)	Accreta or Increta (n=13)	Percreta (n=14)	P
	Media ± SD	Media ± SD	Media ± SD	P
Maternal age (years)	34,93 ± 5,36	31,77 ± 4,51	37,86 ± 4,42	0.0038
Gestational age at delivery (weeks)	35,78 ± 1,87	35,48 ± 1,90	36,12 ± 1,85	0.4808
Gestations	3,85 ± 1,43	3,38 ± 1,12	4,29 ± 1,59	0.1287
Parity	2,00 ± 0,92	1,85 ± 0,80	2,14 ± 1,03	0.3307
Cesarians	1,70 ± 0,99	1,23 ± 0,72	2,14 ± 1,03	0.0174
Abortions	0,78 ± 1,28	0,46 ± 0,66	1,07 ± 1,64	0.5276
SD: Standard Deviation of Mean				

The urological intervention was similar between both groups (Table 2). Prophylactic bilateral ureteral stenting was attempted in all patients, but successful in 81,48% of them. Most of the failures occurred in patients with placenta percreta (4/5), but without significant difference. Despite that, we had no ureteral injuries in our series.

Table 2: Urological Interventions in Patients with Placenta Accreta / Increta versus Placenta Percreta

	Total (n=27)	Accreta or Increta (n=13)	Percreta (n=14)
Bilateral ureteral stent	22/27 (81,48%)	12/13 (92,30%)	10/14 (71,4%)
Bladder invasion	9/27 (33/33%)	0/5 (0%)	9/14 (64,3%)
Bladder suture	10/27 (37,03%)	0/5 (0%)	10/14 (71,4%)
Ureteral reimplantation	0/27 (0%)	0/5 (0%)	0/14 (0%)

Bladder invasion occurred 9 of 27 patients (33,33%), all of them with histological diagnosis of placenta percreta, requiring double layer bladder suture. Just one patient without macroscopic bladder invasion had an iatrogenic bladder injury also demanding suture. Both maternal age and number of cesarean deliveries were also associated with bladder suture, which risk increases 26.41% for each maternal-year-old (95% CI 1.037 to 1.562; p=0.0209) and by 5.7 times for each cesarean delivery (OR= 5.7018; 95% CI 1.7030 to 19,0902; p=0.0005). None of the patients that required bladder suture evolved with urinary fistula.

Regarding the ultrasonographic findings, loss of retroplacental clear zone was present in 100%, doubtless because of inclusion criteria. Multiple placental lacunae corresponded at 40,74%, but other parameters were even less prevalent. Also, none of them significantly associated with neither depth in final diagnosis nor with the risk of bladder suture (Tables 3 and 4). Furthermore, the final ultrasonographic diagnosis was not concordant with the depth of placental invasion (Table 3).

Table 3: Comparison of Us Parameters among Patients with Placenta Accreta / Increta versus Placenta Percreta and the Risk of Bladder Suture

US parameters	Total (n=27)	Accreta or Increta (n=13)	Percreta (n=14)	P*	Bladder suture (n=10)	No bladder suture (n=17)	P**
Loss of retroplacental clear zone	27/27 (100%)	13/13 (100%)	14/14 (100%)		10/10 (100%)	17/17 (100%)	
Interruption uterine-bladder interface	4/27 (14,81%)	3/13 (23,07%)	1/14 (7,14%)	0.3259	1/10 (10%)	3/17 (17,65%)	1.0000
Adjacent bladder wall hyper vascularity	8/27 (29,62%)	4/13 (30,76%)	4/14 (28,57%)	1.0000	3/10 (30%)	5/17 (29,41%)	1.0000
Cervical Hyper vascularity	6/27 (22,22%)	3/13 (23,07%)	3/14 (21,42%)	1.0000	1/10 (10%)	5/17 (29,41%)	0.3625
Multiple placental lacunae	11/27 (40,74%)	7/13 (53,84%)	4/14 (28,57%)	0.1817	2/10 (20%)	9/17 (52,94%)	0.1241
Placental bulge	3/27 (11,11%)	1/13 (7,69%)	2/14 (14,28%)	1.0000	1/10 (10%)	2/17 (11,76%)	1.0000

P*: Significance level $p < 0.05$
P**: Fisher test

Eighteen patients underwent MRI. The most frequent finding was placenta previa (88,89%), followed by placental heterogeneity (72,22%) and intraplacental thick T2 dark bands (55.55%). As well as in ultrasound, no MRI parameters were associated neither to depth (histological diagnosis) nor to the risk of bladder suture (Table 3). Concordance between MRI and histological diagnosis was as poor as observed in ultrasound. Eleven of 18 MRI reported as normal had confirmed the diagnosis of accreta or percreta. (Table 4).

Table 4: Comparison of MRI Parameters among Patients with Placenta Accreta / Increta versus Placenta Percreta and the Risk of Bladder Suture

MRI parameters	Total (n=18)	Accreta or Increta (n=8)	Percreta (n=10)	P*	Bladder suture (n=8)	No bladder suture (n=10)	P**
Abnormal uterine bulge	3/18 (16,67%)	0/8 (0%)	3/10 (30%)	0.2157	2/8 (25%)	1/10 (10%)	0.5588
Myometrium thickness ≤1mm	15/18 (83,33%)	6/8 (75%)	9/10 (90%)	0.5588	7/8 (87,5%)	8/10 (10%)	1.0000
Location of placenta previa	16/18 (88,89%)	8/8 (100%)	8/10 (80%)	0.4771	6/8 (75%)	10/10 (100%)	0.1830
Placental thickness (mm)	31,61 ± 8,18	31,50 ± 6,09	31,70 ± 9,88	0.7532	32,75 ± 10,64	30,70 ± 6,02	0.9642
Placental heterogeneity	13/18 (72,22%)	5/8 (62,5%)	8/10 (80%)	0.6078	7/8 (87,5%)	6/10 (60%)	0.3137
Intraplacental thick T2 dark bands	10/18 (55,56%)	3/8 (37,5%)	7/10 (70%)	0.3416	6/8 (75%)	4/10 (40%)	0.1880
Abnormal intraplacental vascularity	2/18 (11,11%)	0/8 (0%)	2/10 (20%)	0.4771	2/8 (25%)	0/10 (0%)	0.1830
Abnormal intraplacental vascularity	2/18 (11,11%)	0/8 (0%)	2/10 (20%)	0.4771	2/8 (25%)	0/10 (0%)	0.1830
Placental protrusion into the internal cervical os	2/18 (11,11%)	1/8 (12,5%)	1/10 (10%)	1.0000	0/8 (0%)	2/10 (20%)	0.4771

Loss of the utero–placental interface	7/18 (38,89%)	2/8 (25%)	5/10 (50%)	1.0000	3/8 (37,5%)	4/10 (40%)	1.0000
Placental invasion into adjacent structures	2/18 (11,11%)	0/8 (0%)	2/10 (20%)	0.4771	1/8 (12,5%)	1/10 (10%)	1.0000

P*: Significance level $p < 0.05$
P**: Fisher test

Discussion

The abnormally invasive placenta (AIP) is a severe obstetric complication with a high risk of hemorrhage, requiring blood transfusion in 80-90% of cases [5,8], peripartum hysterectomy, fistula formation, damage to other pelvic organs, infection perinatal and maternal death [9]. This broad term covers conditions where placenta can be a true accreta, increta or percreta. The depth of trophoblastic invasion into the myometrium provides a classification of these entities. While placenta accreta and increta affect chorionic villi invasion just into the myometrium, the placenta percreta include an extension to outermost layers of the uterus, which can damage adjacent pelvic organs like the bladder, intestine, and others neighboring tissues. An accurate prenatal diagnosis is fundamental to reduce the worrying maternal mortality and morbidity related to these anomalies.

The incidence of the abnormally invasive placenta (AIP) has increased globally over the past 30 decades, being that now reported to occur in 2-90 per 10.000 births [10]. As the same way, despite WHO recommendations that cesarean section (CS) should not exceed 10-15% of the total deliveries, the prevalence of CS has been increasing worldwide over the last decades, from 6.7% in 1990 to 19,1% in 2014. This fact has been more dramatic in developed countries than in developing areas. However, currently, South America stands out with the highest CS rate (42.9%) [11].

There is a dose-dependent relationship between CS and AIP. Bowman et al. described a large multicenter delivery cohort study which women with the increasing number of prior cesareans were more likely to have an accreta ($p < 0,001$). The odds ratio increases from 2,86 to 12,57 when just one prior cesarean and three or more cesarean, respectively [12]. In our study, for each cesarean delivery increased three times and 5.7 times the risk for AIP and bladder suture, respectively.

Tam et al. in a systematic review reported an incidence of 29% unintentional genitourinary injuries (GI) with AIP during hysterectomy, and bladder lesions, which corresponds by 78% of them [13]. Despite the high rate of accidental GI, this article did not differentiate the incidence by each kind of chorionic villi invasion, while in our study urological intervention was similar between both groups (placenta accreta and increta against percreta).

It is essential to carry out an analysis of the reason for the GI in cases with AIP: an invasion of placenta percreta into the genitourinary tract or unintentional GI. Only one patient had an iatrogenic bladder injury, without macroscopic bladder invasion, while the other 9 cases occurred by AIP (33,3%). Thus, almost one-third of patients with AIP had bladder invasion and required correction with partial cystectomy and double layer suture. A recent retrospective study showed a similar result which described 34% patients that had their bladder or ureter invaded partially by placenta percreta, needing urological repair [14].

Older women giving birth are another independent risk factor for AIP. The median maternal age was 34,93 in our study, and we detected that the chance of placenta percreta increases by 35.7% for each maternal year old. In a bi-national population-based case-control Farquhar et al. observed that mothers 40 or over had more than a 19-fold higher risk for placenta accreta in comparison to young mothers age less than 30 [15].

Janiaux et al. reported a meta-analysis with 14 cohort studies which analyzed 3889 pregnancies presenting placenta previa accreta and demonstrated an accuracy diagnose of 90,9% with ultrasonography during prenatal [7]. In our study, ten of 13 patients (76,92%) had the correct diagnose of placenta accreta, and 13 of 14 patients with placenta percreta were misdiagnosed to accreta by ultrasonography. Therefore, a high number of wrong diagnose occurred on discriminating AIP to accreta / increta or percreta, although a tertiary reference hospital performed all examinations.

Although ultrasonography or MRI parameters had not improved the accuracy to correctly diagnose of AIP and even the risk of bladder lesion, these exams still have been used to correlate surgical and histological findings. The sensitivity and specificity of the ultrasound to diagnose placenta percreta are very variable according to the published studies. The reasons for that are the dependence on operator expertise, and also the location of the placenta when in the posterior uterine wall [7,16]. An attractive alternative is the use of 3D power Doppler, which may improve the specificity for such situations. Cali et al., described high accuracy (sensitivity of 90% and specificity of 100%) of 3D power Doppler as similar as Shih et al. in 2009 (sensitivity 97% and specificity 92%) [17,18].

Like other authors, our current retrospective study confirmed the relationship between maternal age and number of cesareans to increase the risk of AIP. On the other hand, the literature demonstrates high specificity and sensitivity of ultrasonography or MRI, while in our series they could not diagnose AIP during the prenatal evaluation.

This retrospective review of our institutional experience is one of the few comprehensive analyses of a rare obstetric condition, focused on urologic complications. This study has some drawbacks worth mentioning. Selection bias affects all retrospective studies, and ours is no exception.

Moreover, our analysis derived from a single institution, tertiary care center, which potentially could impact generalization. Although our study comprehends cases from 2009 to 2016, only 27 patients fulfilled all inclusion criteria. So, further studies are necessarily attempting to minimize bias and with a larger patient cohort.

Hegazy stated that the placenta accreta attached superficially to myometrium and placenta increta extending deep into myometrium are the common cases, representing together about 95% of cases of

abnormally adherent placenta. However, the placenta percreta the most dangerous one is rare, of only about 5% of cases [19]. This is in contrast with the current study which was evident in 14 from 27 (52%) of cases. This discrepancy might be due to type of the investigated cases with previous history of CS.

Conclusion

Maternal age and number of cesarean deliveries were associated with bladder suture as well as the increased risk of placenta percreta. Nevertheless, neither ultrasonography nor MRI provided any parameter that could predict the depth of placental invasion in histological diagnosis or the risk of urological intervention. Future studies are warranted to explore better the relationship between prenatal parameters images and the correct diagnoses of AIP since the literature demonstrate high sensitivity and specificity.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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